BOĞAZİÇİ ÜNİVERSİTESİ

ISS/EC-2007-11

On the Political Economy of the Informal Sector and Income Redistribution

Ozan Hatipoglu

Gulenay Ozbek

ARAŞTIRMA RAPORU

RESEARCH PAPERS

Boğaziçi University Department of Economics Research Papers are of preliminary nature, circulated to promote scientific discussion. They are not to be quoted without written permission of the author(s).

On the Political Economy of the Informal Sector and Income Redistribution*

Ozan Hatipoglu† and Gulenay Ozbek‡

April 5, 2007

Abstract

In this paper we analyze a general equilibrium model in which agents choose to be employed in formal or in the informal sector. The formal sector is taxed to provide income subsidies and the level of redistribution is determined endogenously through majority voting. We explore how the demand for redistribution determined by majority voting interacts with the incentive to work in the untaxed informal market. We also investigate how different levels of the informal sector wage can explain simultaneous changes in the size of the informal sector and level of redistribution. The model is simulated to produce qualitative results to illustrate the differences between economies with different distributional features. The model accounts for the different sizes of informal sector and income redistribution in Mexico and United States.

JEL Codes: H2, D3, J2

Keywords: Informal Sector, Income Redistribution, Median Voter.

*We express gratitude to Antonio Merlo, Adam Przeworski, Debraj Ray and Friedrich Schneider for helpful comments. We also thank seminar participants at the ASSET Annual Conference in Lisbon (2006) and Public Choice Society Meeting in Amsterdam(2007). We acknowledge the financial support from Bogazici University Research Project 06C103. All errors are our own.

†Corresponding author. Department of Economics, Bosphorus University, Bebek, Istanbul 34342 Turkey. Email: ozan.hatipoglu@boun.edu.tr. Phone:+902123597640

‡Department of Politics. New York University.

1 Introduction

With a large portion of the world's poor in developing countries, why is it that there is little income redistribution in these countries? When the issue is as vital as income one would expect to find a significant popular demand for higher redistribution regardless of the type of regime since even dictators worry about street riots by the masses. In this paper, we present a political economy model that accounts for this puzzle. We argue that the poor in developing countries work in the informal sector to generate supplementary income when the government cannot tax enough from the richer to generate subsidy for the poor. (The precise definition of what constitutes informal market activity will be clarified in the following section.) We show that the government can not tax enough because if the formal sector is not sufficiently lucrative at least some people opt to spend their work hours in the informal sector. In addition, they vote to ease the taxes on those who do so that the formal sector workers can earn enough to provide for themselves and also to give up some of their income for redistribution. Depending on how lucrative the informal sector is and how productive the workers are, people may choose to work in the informal sector to accommodate for their low levels of productivity. This in turns leads to less output in the formal sector with little to redistribute. This is consistent with the observation that the existence of a large informal sector coincides with less redistribution. [1].

Analysis of the size of the informal sector has generally been confined to either growth models or computable general equilibrium models. We adopt the latter line of modeling and add more to it by endogenizing the decision with regard to how much to redistribute. We then simulate the model to study the comparative statics of a developing and a developed economy. We explore how the demand for redistribution determined by majority voting interacts with the incentive to work in the untaxed informal market.

This paper differs from the previous informal sector literature in that we endogenize the choice of tax rate and embed it in a simple labor-leisure choice problem. The novelty of this paper is that it offers an explanation for simultaneous changes in the size of the informal sector and level of redistribution as a result of changes in the informal sector wage skill distribution and identity of the median voter. A distortion in the democratic rule in favor of the rich reduces transfers while the size of the informal sector may remain at high levels. Despite a greater demand for redistribution in societies where the majority has few resources (skills), we find that political systems which work in favor of a rich minority will

[1] Using data from 79 countries, the regression analysis of the size of the informal sector and spending on welfare as percentage of GDP produces a significant negative correlation. See Appendix A for details.

produce little redistribution. When coupled with a suitable wage distribution, the type of political regime acts to reduce transfers much faster than the equivalent reduction in the informal sector. Hence, a political system that is hostile to the poor can work to impede the positive effects of economics growth.

In terms of the theoretical model this paper is related to previous work in several ways. Ihrig and Moe(2004) develop a dynamic model to explain the evolution of the informal sector towards steady state. They show that exogenous reduction in tax rates reduce the size of the informal sector, whereas in our paper the relation depends on the skill distribution and identity of the median voter. We also analyze the relationship when one country moves toward a more democratic-setup by changing the identity of the median voter whose choice of tax rate is endogenous. Dessy and Pallage (2003) develop a heterogeneous-agent model with incomplete markets where the taxes levied on the formal sector is used to finance a public infrastructure which can be accessed only by formal agents. This premium from formalization provides an explanation for the prevalence of a large, low-productivity, informal sector in developing countries. In our paper, we let both sectors reap such benefits since the government uses all tax revenue for redistribution. In our paper, the difference between rich and poor countries is not due to initial conditions, but depends on how democratic the regime is. DePaula and Scheinkman (2006) define informality as tax avoidance, i.e. as undeclared production or sales by officially recorded firms[2], whereas we define informality as illegal production of legal goods by unofficial firms. Our definition emphasizes the role of labor markets in determining the size of informal sector especially in developing countries. The premium to formalization is also featured in Chong and Gradstein (2007) who offer an explanation of the level of informality based on inequality and institutional quality. They find a higher inequality level leads to more informality and this effect is reinforced by poor institutional quality

Because the tax policy is treated as exogenous, most of the literature does not account for why a large informal sector can coexist with little redistribution. The methodological approach of this paper rests both on the median voter literature and on the urban informal sector literature while also building in income redistribution. Following the one-sector Meltzer and Richard (1981) model, the individuals are heterogenous with respect to their earning capabilities[3], and choose the optimal number of hours of work, given a competitive wage rate. Assuming that the government's sole purpose is to redistribute incomes (with no administrative costs), there is a lump-sum subsidy per person which is financed by income

[2]In the literature, this is sometimes referred to as irregular sector.

[3]For a dynamic political-economy model of Meltzer and Richards, see Krussel and Rios-Rull (1999).

tax on income generated in the formal sector. The government adopts the tax level preferred by the majority. Unlike the economic models of the informal sector, the median voter theorem allows us to treat the government as an actor in the political-economic system and hence does not detach it from the electorate. Secondly, following the literature on models of dual economies, we build in a second sector to the Meltzer and Richard set-up. We assume that the workers are homogenous in the informal sector. There is a fixed amount of wage such that an informal sector worker can only earn less than what the lowest productivity worker in the informal sector earns post-tax.

When the distribution of workers is such that a majority is not skilled to earn enough post-tax income in the formal sector, they may choose to work in the informal sector simply because they would rather avoid being taxed. The fact that non-taxation is an indirect form of subsidizing incomes so that the informal sector acts as an alternative mechanism of redistribution is why the majority votes for a small portion of formal sector income, especially when there are not enough formal sector workers to generate subsidy income for the entire population. Since few workers operate in the formal sector, it is normal to find less revenue generated to redistribute (compared to the developed countries). In other words, if the informal sector is profitable enough, it creates work for the low-productivity individuals (who would otherwise be non-workers at home). Creation of new jobs itself becomes a subsidy for the poor. Hence, we conclude that the size of the informal sector and the level of redistribution is the result of the joint effects of distributional factors and how lucrative the informal sector is. The important comparative static that emerges from our analysis is that increasing the wages in the informal sector vis-a-vie the earnings in the formal sector leads to a decrease in subsidies and an increase in the informal sector size, which supports the intuition that non-taxation is an indirect form of subsidizing incomes and that informal sector acts as an alternative way of redistribution.

The rest of the paper is organized as follows. In the next section we briefly discuss the features of the informal sector. In the third section, we describe the theoretical model. In section 4, we discuss the data, and in section 5, we present the results. Section 6 concludes.

2 The Urban Informal Sector

The informal sector has consistently been an important source of income for the poor, especially in developing countries. Hence the size, cause and the consequences of it has been attracting a great deal of attention over the past couple of decades, both by scholars and

by policy-makers alike[4]. As the cities in many developing countries are rapidly growing in size[5], a large proportion of those working in these urban areas derive their income from the informal sector. This is especially significant in Latin American countries where the cities are booming due to lower death rates and higher life expectancy, but also as a result of migration from the countryside[6].

Firms that engage in urban informal economic activity can be described as very small-scale units that are not registered in official statistics. They consist largely of independent, self-employed producers, which in most instances is a family network. Informal firms operate with very little capital, or none at all since they rarely have any access to credit markets. Furthermore, not having formal education or access to training institutions, the workers utilize a low level of technology and skills, which makes them operate at a low level of productivity and therefore earn very low (and irregular) incomes (Sethuraman, 1991). Entry and exit are also easier than in the formal sector. Examples of informal activities may include retail trade, transport, repair and maintenance, construction, personal and domestic services, and manufacturing.

We exclude any criminal activity such as drug-trafficking in the definition of informal work as we use in this paper. Unlike criminal sector, the production and output of the informal sector is entirely legal, however the fact that the output does not appear in national tax accounts makes it illegal. A distinction should also be made between undeclared production by officially recorded firms (irregular sector) and illegal production of legal goods by unofficial firms (informal sector)[7]. The production in the irregular sector (such as tax-evasion, social security fraud, avoidance of labor/safety regulations, etc.), is illegal although the output is not. Although both irregular and informal economic activity are motivated by a desire to avoid costs associated with regulation, these two activities have different dynamics in the sense that, in the irregular sector, the same good is produced with the same production capabilities of the formal sector but with a different profit return. Therefore we

[4]See the special feature in the Economic Journal (1999), and Schneider and Enste (2000) for an extensive literature review.

[5]To give some examples, according to the 1997 World Development Report issued by the World Bank, the percentage of the population living in urban areas of Brazil is 78%, in Mexico, 75%, in Turkey, 70%, and in Lebanon, 87%.

[6]For evidence on Latin America, see Loayza (1994), Portes and Schauffler (1993).On average, the informal sector in Latin America accounted for about a quarter of urban jobs in 1990 varying from 20 to over 50 percent across different Latin countries. During the same year in sub-Saharan Africa, the share of urban labor force in the informal sector was estimated to be around 61 percent and it showed little variation across countries. In Asia, the percentages typically hover around 40-60 percent, but there is a wide variation across its countries [Sethuraman (1998), p.10].

[7]Here we adopt Thomas' (1992) terminology.

restrict ourselves to studying the informal sector only[8].

Before we turn our attention to the formal model, a few comments are in order. We should note that this model abstracts many important features of the informal sector. First of all, we have assumed a fixed informal wage rate to keep the model simple. In fact, Thomas quotes from the 1972 Kenya mission report to the International Labor Organization (ILO) that the informal wage is determined endogenously in the market, although the work is still labor-intensive and locally produced (p.53).

Although the informal sector pays less than the formal sector in most instances, there is a wide diversity of earnings. As ILO's Regional Employment Program, known by its Spanish acronym PREALC, reports in the context of Latin America (Tokman, 1990, p.95), the informal sector wages are still lower than the formal sector earnings. In this model, we take the informal wage to be lower than the informal sector earnings which is in fact confirmed by Mazumdar (1976), and is consistent with the empirical findings of Lemieux, Fortin, Frechette (1994) that "the labor earnings in the underground [informal] sector are concentrated among [would-be] workers with low earnings in the regular sector (p.239, brackets our addition).

Secondly, many scholars have emphasized the costs of operating in either sector (Loayza, 1996; De Soto, 1989, Tokman, 1990). In the formal sector, the firms have to comply with regulations such as labor safety, environmental protection, consumer protection and quality control, as well as bureaucratic requirements such as registration procedures, and other paper work. They also have to pay taxes. Whereas in the informal sector, there are costs to getting caught since the informal firm is penalized if detected. Furthermore, the informal sector cannot take advantage of government-provided goods such as the police and the judicial system. The model as it is now does not reflect the costs associated with staying in either sector.

Thirdly, not all types of informal work is labor-intensive. There is documentation in certain contexts that there are micro-producers capable of producing with modern technology and capital accumulation. However the existence of this type is exceptional in Latin America [Portes and Schauffler, (1993)]. These points show that the informal sector is heterogenous and while we do think that they are very important in characterizing the informal sector realistically, we also believe that the simple model we present here captures the main intuition behind income redistribution when there is an informal sector present.

[8]There is a rather extentive research on irregular sector (sometimes referred to as the 'shadow' or 'black' or 'subterranean' or 'underground' economy), mostly in the context of developed countries [see e.g. Gaertner and Alois (1985), Lemieux, Fortin, Frechette (1994)].

3 The Model

3.1 Structure of the economy

Assume that the workers in the economy differ in productivity, ε, which is assumed to be distributed lognormally so that $\varepsilon \backsim LN(\bar{\varepsilon}, \sigma_\varepsilon^2)$ with support $(0, +\infty)$ and the worker with the median productivity, ε^m, is below the mean, $\bar{\varepsilon}$. In the formal sector there is only one firm which holds the entire amount of capital[9]. The earnings of formal sector workers are subject to tax, whereas the earnings from the informal sector are not. In the formal sector, the workers are price-takers. In the informal sector, the wage $\bar{w}$ is fixed, assuming that everybody who chooses to work here is equally productive in a simple task. Note that $\bar{w}$ is less than what the least productive worker in the formal sector can make.

The workers get utility from consumption c and leisure l, assuming that $u(c, l)$ is strictly concave in l, and that both consumption and leisure are normal goods. We specify the utility function as a Cobb-Douglas function

$$u = (1 - a)\ln(c) + a\ln(l) \tag{1}$$

where $0 < a < 1$.

Since an individual has the option of working in both (or in any) of the sectors, his consumption is the total of after-tax wages in the formal sector, the informal market earnings, and the subsidy he receives after the decision with regard to the tax level is made. He maximizes his utility over the amount of work he supplies to either sector

$$\max u \text{ subject to } c = (1 - t)n^f w^f \varepsilon + n^i \bar{w} + s \tag{2}$$

$$\begin{aligned} l &= 1 - n^f - n^i \\ l &\geq 0,\ n^f \geq 0,\ n^i \geq 0 \end{aligned}$$

where n^f and n^i are the ratio of hours of work in the formal and the informal sector respectively to their total time, w^f is the formal sector wage rate, $\bar{w}$ is the fixed informal sector wage, t is the tax rate, s is the lump-sum subsidy, and time endowment is normalized to 1. Note that there are no entry costs to switching to the informal sector. There is no

[9] Or, there is a large number of homogenous firms.

solution for which both n^f and n^i are positive because first order conditions hold individually but not simultaneously as a result of additively separable utility[10]. In other words, a particular worker will not mix between the informal and formal sector. He is indifferent between working in the formal or the informal sector when his after-tax earnings in the formal sector is equal to what he can make in the informal sector.

Looking for the optimal mix of n^f and n^i, satisfying the first order conditions give

$$\bar{w} = (1-t)w^f\varepsilon \tag{3}$$

The optimal share of hours of formal work for an individual, given that his productivity is above a certain threshold (otherwise he will choose not to work and receive subsidy), is given by

$$n^{f*} = (1-a) - \frac{as}{(1-t)w^f\varepsilon} \tag{4}$$

And following from (4), the optimal share of the amount of informal sector work (given that the equilibrium state of the world is the informal sector) is

$$n^{i*} = (1-a) - \frac{as}{\bar{w}} \tag{5}$$

Notice that the hours of work in the informal sector (and the earnings from that sector) do not depend on the level of productivity[11], precisely because we have assumed the same level of productivity for all workers as soon as they enter this market. In other words, the indirect utility an individual derives from the informal sector is greater than the indirect utility of not working at all, when $n^i > 0$.

Solving equation (4) for ε, we can now specify a critical level of productivity ε^* for formal sector

$$\varepsilon^* = \frac{\bar{w}}{(1-t)w^f} \tag{6}$$

For individuals with productivity level above ε^*, after-tax earnings in the formal sector are larger than the informal sector income, hence they devote all their work hours to the formal sector.[12]

[10] See Appendix A

[11] Let n^f in equation (4) go to zero to see that the optimal hours of work in the informal sector depends only on s and on the exogeneous parameters of the model.

[12] *If* $\varepsilon > \varepsilon^*$, *then* $n^{f*} = 1 - l^*$ *and* $n^i = 0$.*If* $\varepsilon < \varepsilon^*$, *then* $n^{f*} = 0$ *and* $n^i = 1 - l^*$.

There is also a critical productivity level below which the individual will choose not to work at all and simply receive the government subsidy. Let the fractions of time allocated to work (in both sectors) equal to zero in (4) to find

$$(1-a)(1-t)w^f\varepsilon = as$$

Solving for the cut-off level of productivity ε^{**}, we get the following for the informal sector

$$\varepsilon^{**} = \frac{as}{(1-a)(1-t)w^f} \tag{7}$$

When $\varepsilon^{**} < \varepsilon^*$ (i.e. there are no non-workers) , and following from (4) and (5), the following inequality holds

$$(1-a)\bar{w} > as$$

This is not surprising because if the informal wage is appreciated more than the subsidy, then the informal sector appears as a better alternative to non-work. Hence, when $\varepsilon^{**} < \varepsilon^*$, all individuals who choose not to work in the formal sector, will always work in the informal sector.

These results imply that there are three possible states of the world. First of all, a formal sector might coexist with an informal sector, in which case a worker always devotes all of his work hours to one sector. In this equilibrium, there are no non-workers. This is the case when $\varepsilon^* > \varepsilon^{**}$. However, if $\varepsilon^{**} > \varepsilon^*$, then the informal sector vanishes. This is the second possible state of the world: when people either work in the formal sector or stay home to receive a subsidy income. And finally, there might be a world where everybody chooses to be employed in the formal sector (i.e. $\varepsilon^* = 0, \varepsilon^{**} = 0$). It is not possible to have a state where $\varepsilon^* = 1$ because of the assumption that "$\bar{w}$ is less than what the least productive worker in the formal sector can make". In other words, even if the the distribution is such that almost everybody is an unskilled worker, there is at least somebody who would be better off working in the formal sector.[13].

We now need to know the formal sector wage rate, w^f. The firm sets w^f equal to the marginal product of the effective labor force L. For simplicity, we assume that the production function is a simple linear function of the form

[13] An equilibrium, where everybody would prefer not to work, is not sustainable because there will be no income generated.

$$Y = G(K)L$$

where G is an exogenous function of capital K. Therefore, the wage rate in the formal sector is

$$w^f = \frac{\partial Y}{\partial L} = G(K) \tag{8}$$

Plugging the expression for w^f into (8), (9) and (6) respectively gives

$$\varepsilon^* = \frac{\bar{w}}{(1-t)G(K)} \tag{9}$$

$$\varepsilon^{**} = \frac{as}{(1-a)(1-t)G(K)} \tag{10}$$

$$n^{f*} = (1-a) - \frac{as}{(1-t)G(K)\varepsilon} \qquad \text{for } \varepsilon > \varepsilon^* \tag{11}$$

3.2 Competitive and Political Economic Equilibrium

In this paper, we discuss two types of equilibria, namely the competitive equilibrium with exogenous taxes and political economic equilibrium with endogenous taxes. Under competitive equilibrium the model produces results similar to those found in the previous literature on informal sector. These are summarized in the following proposition.

Proposition 1. An increase in the tax rate shrinks the formal sector size and increases unemployment.

Proof: See Appendix B.

This is not surprising since more workers will find it better to work in the informal sector and more than make up for the loss in income by not paying taxes. An increase in taxes will have two opposite effects on employment. Firstly, it will increase the threshold, ε^{**}, for participation in the labor force as shown in equation 10. Second, by inducing entry to the informal sector from the formal sector, it causes a decrease in subsidies which in turn lowers the threshold for employment. The first effect dominates the second for all choices of tax rates.

To discuss the political economic equilibrium we refer to the median voter theorem. As Roberts (1977) proves and as Meltzer and Richards (1981) apply in their paper, the voter

with the median income is decisive in the choice of the tax level if the post-tax income of the individuals, y, is monotonically ordered by their productivity for all s and t, given that the voting is over only one of those policies. And if the ordering of individual incomes is independent of the choice of s and t, then the individual choice of tax rate is inversely ordered by income.

To formally prove this point within the context of this paper consider the balanced budget requirement for the government :

$$s = t\bar{y} \tag{12}$$

where $\bar{y}$ is the total income generated in the formal sector. Under any tax schedule, the richer will still be relatively richer than a poorer individual after redistribution (although relatively less richer), assuming that the voting space is unidimensional, i.e. the individuals do not solve the problem of taxation and redistribution independently of each other. This is enough to establish that the choice of the tax rate is ordered by productivity, for all s and t. Using (8) and (11), the income of a formal sector worker is

$$y = n^f w^f \varepsilon = \varepsilon(1-a)G(K) - \frac{as}{(1-t)} \tag{13}$$

$$\frac{\partial y}{\partial \varepsilon} = (1-a)G(K) > 0, \qquad \forall (s,t) \tag{14}$$

Equation (13) shows that individuals can be ordered monotonically along the productivity dimension and this ordering still holds true regardless of the tax policy to be chosen. Also remember that the informal sector wage is at the lower end of the earnings spectrum so that it does not violate monotonicity. From (14), the income of an individual is inversely correlated with his preferred tax rate, but positively correlated with his productivity. Therefore, a high-productivity worker will prefer a low tax rate. The worker with the median productivity will decide on the policy. Finally, we show that the subsidies are uniquely determined by the choice of tax rates.

Proposition 2. There is a unique level of subsidy, s, that is determined by $\bar{y}$ for each t,

Proof: See Appendix B.

We have assumed a continuous distribution of productivity among workers, where $\varepsilon \backsim LN[0, +\infty]$ and the worker with median productivity, ε_m is below the worker with mean productivity, $\bar{\varepsilon}$. Since the preference of the median voter prevails, we are interested in

the worker with the median productivity. His choice of t, hence s, determines the size of redistribution, provided that $\varepsilon^* < \varepsilon_m < \bar{\varepsilon}$. However, each particular position of the median voter below the mean will produce different equilibrium levels of redistribution. The relationship between ε^m and t^* is depicted in Figure 1.

Insert Figure 1 About Here

The intuition behind the picture is as follows. We know that the worker at $\bar{\varepsilon}$ does not gain from redistribution so the preferred rate of tax of a decisive voter at this point is $t = 0$. A median worker who is not in the formal sector (regardless of whether the informal sector exists or not), will have the highest tax rate that he can choose, $t_{\max}$. All he cares about is to maximize the subsidy he receives (since the informal sector earnings is independent of the threshold). But the equilibrium tax rate has to be less than 1 because he will be concerned about the effects of disincentives to work on the formal sector workers. Between $t_{\max}$ and $t = 0$, we expect to find a monotonically decreasing slope because the median voter is in the formal sector and is subject to both distortionary and wealth effects as we have discussed at the beginning of this paper[14].

To formally prove this intuition behind the graph, we have to consider the individual problem of the median voter in each sector. If the equilibrium state of the world is such that the informal sector exists, then $t_{\max} = t^{i*}$, the preferred tax rate of a median voter who works in the informal sector. Since the productivity of anyone who works in the informal sector is the same by assumption, anybody below ε^* including the median voter have the same preferences. The utility function for those working in the informal sector is

$$u^i = (1-a)\ln\left(n^i\bar{w} + s\right) + a\ln\left(1 - n^i\right)$$

Their preferred level of tax is derived by solving (15) for t^{i*} after substituting (5) and (12),

$$\frac{d}{dt}\left[(1-a)\ln\left((1-a)\left(\bar{w} + t\bar{y}\right)\right) + a\ln\left(a + \frac{at\bar{y}}{\bar{w}}\right)\right] = 0 \tag{15}$$

If ε^{**} is binding, i.e. there is no informal sector, then those individuals with productivity below this cut-off point are non-workers with the following utility function

$$u^n = (1-a)\ln s$$

[14]The intuition we provide might explain a decreasing but not necessarily a monotonic line. Secondly, the line need not be linear as seen in the diagram.

where the superscript n denotes 'non-work'. Their (and a non-worker median voter's) preferred level of tax, $t_{\max} = t^{n*}$ is determined by solving (16)

$$\frac{d}{dt}\left[(1-a)\ln\left(t\bar{y}\right)\right] = 0 \tag{16}$$

A median voter with productivity above ε^* is a worker in the formal sector and will have a preferred rate of tax that decreases with ε [15] as indicated by the sloped line in Figure 2.

The utility of the median voter in the formal sector is

$$u^f = (1-a)\ln\left((1-t)\,n^f w^f \varepsilon^m + s\right) + a\ln\left(1-n^f\right) \tag{17}$$

Substituting (8) and (11) into (17)

$$u^f = (1-a)\ln\left((1-t)\varepsilon^m(1-a)G(K) - as + s\right) + a\ln\left(a + \frac{as}{(1-t)G(K)\varepsilon^m}\right)$$

The median voter chooses a tax rate that balances the government budget and maximizes his own utility subject to his own budget constraints, and solves the following

$$\frac{d}{dt}\left[(1-a)\ln\left(y^m + (1-a)t\bar{y}\right) + a\ln\left(a + \frac{at\bar{y}}{y^m}\right)\right] = 0 \tag{18}$$

where the income of the median voter y^m is a function of his own preferred tax rate. Note that $\bar{y}$, which enters into the optimization problems of all types of decisive voters [equations (15), (16) and (18)] is again a function of their own preferred tax rate[16]. Hence it is not possible to characterize the equilibrium rates of tax in functional form and compare which equilibrium is higher. However we can represent each individual problem in terms of equilibrium deadweight losses created by each equilibrium level of tax. These deadweight losses allows us to compare equilibrium tax rates among different skill distributions (hence the amount of redistribution), if not the equilibrium size of the informal sector.

Proposition 3. The tax rate for the non-worker is fixed , the tax rate chosen by the informal worker is decreasing by the leisure parameter, and it is increasing by the informal wage. The tax rate for the formal worker is always decreasing by the median voter's income.

Proof :

[15] Note that $\frac{\partial y}{\partial t} < 0$ from (15)

[16] See equation (18) and note that the lower limit of the integral is determined by the critical threshold level which itself is a function of t.

The solution to equation (16) yields the following deadweight loss

$$\frac{t}{\bar{y}}\frac{d\bar{y}}{dt} = \mu^n = -1 \tag{19}$$

Equation (15) gives

$$\frac{t}{\bar{y}}\frac{d\bar{y}}{dt} = \mu^i = -1 + a(1-\bar{w}) \tag{20}$$

and (18) gives

$$\frac{t}{\bar{y}}\frac{d\bar{y}}{dt} = \mu^f = -1 + \frac{y^m}{\bar{y}} \tag{21}$$

where μ indicates the deadweight losses incurred by the equilibrium level of tax in each case.[17]

Proposition 4 Suppose the informal sector exists (so that non-work is no longer profitable) with $0 < y^m < \bar{y}$ *and* $0 \leq \bar{w} \leq 1$, *then* $t^{i*} > t^{f*}$ *if* $a < \frac{y_m}{\bar{y}} < 1$. *If* $0 < \frac{y_m}{\bar{y}} < a$, *i.e. the skill distribution is skewed enough, the median voter does not necessarily prefer a higher tax rate. If* $1 < \bar{w}$ *then* $t^{i*} > t^{f*}$ *regardless of the distributional features.*

Proof: See Appendix B.

Overall, the above proposition implies that the choice of tax rate is an inverse u-shaped function of the informal wage given the distribution is skewed enough. As informal wage increases, the positive income effect of switching to informal sector initially dominates the incentives from choosing lower tax rates. A further increase in the informal wage, however , implies less inequality and a faster increase in the informal sector size which decreases subsidies substantially. In this case, a median voter in the informal sector prefers a lower tax rate to keep informal sector from growing and subsidies from falling.

In the next section we rely on numerical techniques to find the political economic equilibrium of the model and to analyze the effects of policy changes on the choice of the tax rate, the informal sector size as well as the welfare.[18]

[17] Note that if there is no informal sector, a non-worker median voter sets a higher tax rate than if he were in the formal sector, i.e. $t^{f*} < t^{n*}$. This follows directly from (19) and (21) since $0 < \frac{y^m}{\bar{y}} < 1$. This case holds true only if the informal sector wage rate $\bar{w}$ is not high enough to eliminate the non-work sector (to be precise, "the ratio of $G(K)/\bar{w}$ is not low enough"). It does not make sense to compare the decision of the non-working median voter with the decision of the median voter in the informal sector [i.e. equations (19) and (20)] because these two situations cannot exist simultaneously.

[18] For the analytical exercise in endogenizing tax rates see Appendix B.

4 The Data

To characterize the heterogeneity of the agents in the model, we used hourly wage distributions for USA for the year 1990 and Mexico for 1992[19]. Although the base years are different, we assume that the changes in the skills of the Mexican worker between 1990 and 1992 are not significant to alter the results. The USA hourly wage distribution is taken from Imrohoroglu, Merlo and Rupert (2000), who use data from the March Current Population Survey of the Bureau of the Census for the survey year 1991 to examine the relationship between crime and redistribution[20]. Of this data, women, those who are reported as retired, working in the military, in school, disabled, and 65 years of age or older are eliminated. The restricted sample size contains 30,472 cases. Since the data does not account for the earning capabilities of the officially unemployed, the authors use a standard Heckman two-step procedure to obtain unbiased structural parameters of the model. The mean and the standard deviation of the corrected sample are 2.28 and 0.69, respectively, which imply an average hourly wage of \$12.40 with a standard deviation of \$9.70.

The Mexican monthly wage distribution is from the National Statistical Institute of Mexico. The data covers 8756 cases, both men and women who work in various industrial and service sectors and is not corrected for sample selection. Although the qualitative results remain unaffected for the purposes of this paper, we discuss the effects of sample selection problem in the next section. The biased mean and the standard deviation are 6.79 and 1.38 respectively, which correspond to and average monthly wage of \$888.91 with a standard deviation of \$665.31.

Regarding the 'share of leisure' parameter a, we chose 0.64 for USA which is consistent with many calibration studies [see e.g. Kydland and Prescott (1982)] and the empirical literature on time use [see, e.g. Juster and Stafford (1991)]. For Mexico, we used 0.46, which is the value for the developing countries as reported by the World Bank. These figures imply that in the US, a worker spends about one third of his discretionary time working, whereas for a Mexican worker this ratio is about one half.

5 Results

In this section we discuss the findings of the simulation. We start by examining the political-economic equilibria generated by the median voter. We further check for comparative statics

[19] These particular years are chosen out of convinience and avaliability.

[20] The data refer to the calender year proceding the March survey.

with respect to the given variable in the model, namely the informal sector wage, and also consider the effects of a flawed democratic system. Finally we examine the sensitivity of our results to the choice parameter a.

To provide terms of comparison for the numbers generated, here is a brief summary of the statistics of the US and Mexican economies. In 1990, the GNP per capita in USA was \$22,276, and social welfare expenditures net of expenditures on education and transfers to the elderly were 7.8 percent of GNP[21]. In 1992, the GNP per capita in Mexico was \$2,490[22], and the same type of welfare expenditures were virtually non-existent [23]. The reported sizes of the informal sector vary depending on the method used[24]. Unfortunately, sources do not systematically compare different methods for all countries, let alone present information for any year. Schneider and Enste(2000) report the size of the informal sector in USA in 1995 to be 9.5 percent of GDP[25]. According to PREALC, the 1989 estimate of the urban informal employment as percent of the urban economically active population in Mexico was 34.8[26]. However, the PREALC figures are criticized heavily by Portes and Schauffler for underestimating the actual magnitude of those engaged in informal economic activities because it focuses only on self-employed workers excluding professionals, unremunerated family workers, domestic servants, and rural workers. The authors argue that economically active urban population not covered by social security is a better proxy, which yields a 46.8 percent.

5.1 Political-Economic Equilibria

In this subsection, we describe the equilibrium determined by the median voter in the economies characterized by the parameters described as above, given that the informal sector pays 0.2 times an average formal job. For both USA and Mexico, this ratio is enough for the informal sector to dominate the option of 'non-work', and induce all those who would stay home and simply receive the subsidy to go out and seek informal work. In a developed country the decisive worker is most likely a formal worker as there are relatively more skilled people. The median voter in USA prefers a tax rate of 28 percent and the size of the informal sector is 6.5 percent, while the income of an average worker is \$20,960. Whereas in a developing country, the decisive voter is more likely to be a poor worker since

[21] U.S. Department of Commerce (1995).
[22] World Bank (1992).
[23] IMF (1992).
[24] For the survey method, calculations also depend on the definition of what constitutes informal work
[25] As percentage of GNP and calculations based on currency demand approach.
[26] Portes and Schauffler (1993), p.42.

the wage (productivity) distribution is strongly right skewed. Given the skill distribution in Mexico, the equilibrium tax is 72 percent which is the maximum rate that an informal worker would choose. Therefore, given the same estimate of relative profitability of informal work compared to what the average formal job would pay, the equilibrium is a high taxes with a large informal sector of 66 percent. The total income of the average worker is $9,571.

The results for the US economy are fairly close to the real figures as we described at the beginning of this section, with the exception of level of subsidies but the figures for Mexico are highly optimistic. Selection problem should be partly responsible for such high figures but should not be enough to bring the tax level down to the reported levels. Assuming there are more unskilled workers in Mexico, we expect the truncation to be stronger than the US sample. Once corrected, we would expect the threshold to decrease more than the decrease in the position of the median voter, who now becomes a worker in the formal sector. This would have to effect of reducing both taxes and the size of the informal sector to lower levels. However, the illustration is still very useful so far to draw an important conclusion: Depending on the properties of the wage distribution, an economy that has an even more generous a welfare system than another may also produce a considerably bigger informal sector. We are not aware of any work in the informal sector literature that address the issue of distributional factors on either the size of the informal sector or the level of transfers. However, our observation is consistent with the findings in the economic growth literature that "there will be a strong demand for redistribution in societies where a large section of the population does not have access to productive resources of the economy" [Alesina and Rodrik, 1994, p.484; also see Benabou (1996)].

5.2 Comparative Statics

Equation (9) indicates that the size of the informal sector varies with the ratio of the informal sector wage to the formal sector wage rate. In other words, it is not the absolute but the relative informal wage that draws or drives away workers. We normalize the amount of capital (i.e. the wage rate in the formal economy since $G(K) = w^f$) to 1 in both countries, which allows us to test for the impact of the level of economic development or an exogenous change in the profitability of the informal sector at the same time simply by varying $\bar{w}$. Obviously, USA and Mexico do not have the same amount of physical capital. However, since the size of the informal sector and redistribution are determined by relative wages, the level of development defined by the wealth of capital in the economy does not affect the level of redistribution as long as the relative lucrativeness of the informal sector remains the

same across countries. What is really affected by the exact value of $G(K)$ is the amount of income generated in the formal sector which is a part of the total income. This is also the reason why the total income of the Mexican economy generated by the model turns out to be unrealistically high ($11, 396). A small $\bar{w}$ can be possible either because there is now more physical capital in the economy (higher economic development), or because the informal sector is evolving to pay off more.

Holding other parameters constant, we find that an increase in $\bar{w}$ causes the equilibrium level subsidies to rise slightly initially, but then drop consistently, while there is an increase in the size of the informal sector. The initial rise is due to the fact that since some workers switch to the informal sector now that it pays more, the median voter tries to compensate for the loss in income (hence in the subsidy he receives) by increasing the tax rate. However, as $\bar{w}$ increases and as even more people switch to the informal sector, the distortionary effects of taxation has more importance. When the formal sector shrinks, the median voter receives less subsidies. Therefore, he compensates for the loss in his total income by lowering taxes on his income. His decision is to maximize his total income while at the same time he has to make a trade off between the two different sources of income. Table 1. below shows the generated figures for the US and Mexican economy. The first column shows how much the informal sector pays as a ratio of average formal sector wage. The first and and second columns are the size of redistribution for USA and Mexico respectively, whereas the third and fourth columns are the sizes of the informal sectors. Note that when $\bar{w} = 0.1$, the equilibrium state of nature for both countries is a formal sector without the informal sector, which is not profitable enough to appear as a source of income.

Lower subsidies and a bigger informal sector supports the idea that informal work is a substitute for redistribution. The same qualitative results hold true for Mexico without the initial rise because the median voter is now an informal sector worker. His concern is only to maximize subsidies without attracting too many workers into the informal sector and over-reducing the formal sector earnings (which will be taxed to provide that subsidy).

Table 1 About Here

Although the above experiment explains why we might observe low redistribution with high informal sectors, the figures for the Mexican welfare system still turn out to be unrealistically generous. In order to produce the quantitative differences between Mexico and USA, we have to move away from the democratic set-up. In other words, it is not realistic to expect labor laws to be sufficient, or to expect labor unions to operate without suppression to the extent that it would be in the USA. By letting the preferences of the richer (as opposed

to the majority) prevail, the equilibrium is a lower redistribution with smaller non-formal sector. The interesting result is, after a certain level of bias in favor of the richer, the system can produce huge tax cuts with just a slight increase in authoritarianism. For example a 1 percent increase in the position of the decisive voter from the 74the percentile to 75th decreases taxes from 20% to 5%, keeping the same informal/formal wage rate. Large tax cuts imply large subsidy cuts but may not mean a sharp decrease in informal activity. Assuming that the government is responsive to the interests of a formal worker in the 74th percentile as a benchmark, the equilibrium size of the informal sector is 37%, the average income is \$13,939. Now, if the decisive voter is in the 75th percentile, then the drop in the taxes (and subsidies) increases the profitability of the formal sector and attracts more workers into that sector, shrinking the informal economy by 5%. The fact that the formal sector is larger in this case compared to 'democratic Mexico' is due to lower taxes, which makes this sector more appealing for at least some more people. Table 2 gives the comparative statics results where the first row is the position of the median voter along the income percentile scale.

Table 2 About Here

If the distribution of incomes is skewed enough (to the right), high redistribution with large informal sector will still be an appealing alternative when we allow the decisive voter to be richer, as seen in the first three columns. However, after a certain percentage, the amount of rich people in the economy decline so radically that the cuts in taxes are equally large. Since there is no change in the profitability in the informal sector to compensate for the loss in redistribution, we do not observe an increase in its size. When coupled with a suitable wage distribution, the type of political regime acts to reduce the size of welfare transfers much faster than the equivalent reduction in the informal sector. Hence, a political system that is hostile to the poor can work to impede the positive effects of economic growth. This is apparent in Loayza's (1994) observation that 'informal employment declines in importance as the general level of development rises' However, it remains large even in high-income developing countries, in which it employs 31% of the labor force" (p.2). Table 3. summarizes the findings across USA and two different political regimes in Mexico, while keeping the parameters of the distribution and choice variables constant as indicated in section 4. The first row refers to the level of redistribution (taxes), the second is the size of the informal sector, and the thirds row is the total income in the economy.

Table 3 About Here

Therefore, in reality we might observe high informal sectors with high redistribution and also the same with low redistribution in developing countries depending on how democratic the regime is. However, the overall welfare (measured by the average income in the society) is higher than it would have been under total democracy simply because the high-productivity is not heavily taxed, and these workers pull up the average.

5.3 Sensitivity Analysis

The leisure parameter, a, in the utility function is inversely correlated with subsidies but positively correlated with the size of the non-formal sector while the equilibrium remains robust. In other words, when people do not value consumption as much, they also do not care about subsidies or wages as much either. They are also more likely to work less hours in the formal sector, or not work at all, which points to a decline in total income of the median-productivity worker. As we have indicated before, a worker in the developing country is likely to spend about half of his time off work, whereas in a developed country, a worker spares about two thirds of his time for leisure activities. Table 4 shows a change in a for the US economy. Same qualitative results hold true for Mexico.

Table 4 About Here

6 Concluding Remarks

In this paper, we have constructed a general equilibrium model to analyze incentives for workers to engage in informal economic activity and determine the level of redistribution in a political-economic equilibrium, while treating the distribution of productivity and the informal sector wage as exogenous. We then simulated the model since it was not possible to obtain a close-form solution. The purpose of the simulation is not to reproduce the statistical figures for the US and Mexican economies, but to illustrate the nature of the relationship between redistribution and informal sector while accounting for the coexistence of varying levels of informal sectors and welfare systems. The model is simple and excludes issues such as costs to regulation and punishment, competitive informal sector wages, capital formation in the formal sector, and the rural informal sector. Despite these simplifications however, the political aspect of the model, which has been entirely ignored in the literature, brings in an important dynamic to the analysis .

We have shown that the informal sector operates in a way to reduce the burden of redistribution by creating work for poor, low productivity people who otherwise would be

solely dependent on government subsidy. In fact, the demand for redistribution declines as the profitability in the informal sector rises. However, the informal sector earnings is not enough to explain some of the observations in the world. A distortion in the democratic rule in favor of the rich also reduces transfers while the size of the informal sector may remain at high levels. Despite a greater demand for redistribution in societies where the majority has few resources (skills), we found that political systems which work in favor of a rich minority will produce little redistribution. If this is a developing country where there are a lot of poor, uneducated workers, a more lucrative formal sector may not be taken advantage of by the majority unless the skill distribution is improved. This certainly calls for pro-poor measures such as free training and education programs should be offered to those who cannot afford it. In most instances, it is also possible to gain skills on the job, and then move to a better-paid job in the informal sector using similar skills (Sethuraman, 1998).

This model can also account for how much of the informal sector is "voluntary" in a particular economy. Involuntary informal employment can arise if some of the workers who has incentive to chose the formal sector cannot find employment in that sector, and consequently shift to alternative work. The policy prescription here is to promote the establishment of more jobs in the formal sector, which is the view that PREALC upholds for Latin America. However, determination of the magnitude of "voluntary" employment necessarily depends on the use of available statistics, which as we mentioned before is beset with many difficulties. Different estimation methods make the interpretation of economic models rather difficult and can lead to contradictory policies.

7 Appendix

Appendix A. Regression Analysis .

We use Penn World Table 6.2 for GDP data, IMF Government Finance Statistics Yearbook 2001 and 2003 for social security and welfare spending, and Schneider (2002) for data on informal sector size. We exclude the formerly communist countries from the sample set. We regress social welfare expenditures per capita on the informal sector size as a percentage of GDP using GDP per capita as the control variable. The coefficient of the informal sector size is -0.025 with a t-statistic of -2.60.

Appendix B. Proof of Propositions in the Text.

Proof of Proposition 1.

Assuming that t is exogenous, it is easy to see from (9) that an increase in taxes will correspond to an increase in ε^*. In other words, the formal sector shrinks.

To see how ε^{**}, and therefore unemployment, is affected by an exogenous change in t, reconsider the formula for the leisure threshold assuming $G(K) = 1$.

$$\varepsilon^{**} = \frac{at\bar{y}}{(1-a)(1-t)}$$

A change in the tax rates at the top and bottom of the ratio will have the same affect on ε^{**}. However, we need to know how y changes to reach a conclusion. Expand and re-group the expression for average income in (17) to get

$$\bar{y} = \frac{(1-a)\int_{\frac{\bar{w}}{1-t}}^{\infty} \varepsilon f(\varepsilon)\, d\varepsilon}{1 + \frac{at}{1-t}\left(1 - F\left(\frac{\bar{w}}{1-t}\right)\right)}$$

where $1 - F\left(\frac{\bar{w}}{1-t}\right)$ is the cumulative distribution of ε from $\frac{\bar{w}}{1-t}$ to ∞. So far, we cannot tell how $\bar{y}$ behaves as t changes. An increase in t decreases the numerator but may increase or decrease the denominator. So, plug this back into the expression for ε^{**} and multiply top and bottom by $(1-t)$ to get

$$\varepsilon^{**} = \frac{at\int_{\frac{\bar{w}}{1-t}}^{\infty} \varepsilon f(\varepsilon)\, d\varepsilon}{(1-t) + at\left(1 - F\left(\frac{\bar{w}}{1-t}\right)\right)}$$

It is obvious that as $\lim_{t\to 0} \varepsilon^{**} = 0$

$$\lim_{t\to 1}\varepsilon^{**} = \frac{-1 + a - f\left(\frac{\bar{w}}{1-t}\right)\frac{\bar{w}}{(1-t)^2}}{\left[a\int_{\frac{\bar{w}}{1-t}}^{\infty} \varepsilon f(\varepsilon)\, d\varepsilon\right] - \left[at\left(\frac{-\bar{w}}{(1-t)^2}\right)\frac{\bar{w}}{1-t} f\left(\frac{\bar{w}}{1-t}\right)\right]} = \frac{0}{0}$$

where $f\left(\frac{\bar{w}}{1-t}\right)$ is the lognormal distribution of ε at $\frac{\bar{w}}{1-t}$. Since taking the first derivative does not give a solution, we consider the second derivative. Plugging in the expression for the lognormal distribution gives

$$\lim_{t\to 1}\varepsilon^{**} = \frac{-1 + a - \left(\frac{1}{\sqrt{2\pi}\sigma\left(\frac{\bar{w}}{1-t}\right)} e^{-1/2\left(\left(\ln\left(\frac{\bar{w}}{1-t}\right)-\mu\right)/\sigma\right)^2}\right)\frac{\bar{w}}{(1-t)^2}}{\left[a\int_{\frac{\bar{w}}{1-t}}^{\infty} \varepsilon f(\varepsilon)\, d\varepsilon\right] - \left[at\left(\frac{-\bar{w}}{(1-t)^2}\right)\frac{\bar{w}}{1-t} f\left(\frac{\bar{w}}{1-t}\right)\right]} = \frac{0}{0}$$

Taking the second derivative of the above expression results in

$$\lim_{t\to 1}\varepsilon^{**} = \frac{-\frac{e^{-1/2\left(\left(\ln\left(\frac{\bar{w}}{1-t}\right)-\mu\right)/\sigma\right)^2}(1-t)^3}{\sqrt{2\pi}\sigma}}{\left[a\int_{\frac{\bar{w}}{1-t}}^{\infty}\varepsilon f(\varepsilon)\,d\varepsilon\right]-\left[\frac{-\bar{w}at\sqrt{2\pi}\sigma e^{-1/2\left(\left(\ln\left(\frac{\bar{w}}{1-t}\right)-\mu\right)/\sigma\right)^2}}{(1-t)^4}\right]} = \frac{0}{0}$$

To see the effect of increasing taxes on ε^{**} we rely on numerical methods because $\lim_{t\to 0}\varepsilon^{**} = \frac{0}{0}$ and applying the L'Hospital Rule successively does not simplify the problem. Using US parameters the above function produces the following graph. Note that the below result is robust to changes in the distributional parameters and the leisure parameter, a.

Figure A1 About Here

Proof of Proposition 2:

Consider the average income which depends on the formal wage rate and the effective labor force L,

$$\bar{y} = \frac{Y}{N} = w^f L$$

where Y is the total income and N is the number of workers, which is normalized to 1. Hence $\bar{y} = Y$. Substitute (10) to get

$$\bar{y} = \frac{Y}{N} = G(K)L$$

The effective labor force is

$$L = \int_{\varepsilon^*}^{\infty} n^f(\varepsilon)\varepsilon f(\varepsilon)d\varepsilon$$

The expression for average income becomes,

$$\bar{y} = G(K)\int_{\varepsilon^*}^{\infty} n^f(\varepsilon)\varepsilon f(\varepsilon)d\varepsilon$$

Now substitute (11) to get

$$\bar{y} = G(K)\int_{\varepsilon^*}^{\infty}\left[(1-a)-\frac{as}{(1-t)G(K)\varepsilon}\right]\varepsilon f(\varepsilon)d\varepsilon$$

Plug (17) back into the balanced budget equation in (14)

$$s = G(K)t \int_{\varepsilon^*}^{\infty} \left[(1-a) - \frac{as}{(1-t)G(K)\varepsilon} \right] \varepsilon f(\varepsilon) d\varepsilon$$

The proposition is true if there exists a fixed point to the above equation. Holding t fixed, the right-hand side (RHS) is declining in s, and the left-hand side (LHS) is increasing in s. When $s = 0$, $LHS < RHS$, and RHS goes to negative infinity while $LHS > 0$ as s goes to infinity. Therefore, there is a unique s as a function of t. Note that changing the tax rate affects LHS ambiguously. Also note that the LHS and RHS are not necessarily linear functions of s.

Proof of Proposition 4:

(I) If the median voter is in the formal sector, and $0 < y^m < \bar{y}$, then conditions regarding $\bar{w}$ have to be checked.

(i) If $0 \leq \bar{w} \leq 1$,

$$\frac{y_m}{\bar{y}} \quad ? \lesseqgtr ? \quad a\,(1-\bar{w}) \tag{22}$$

To check the boundaries, let $w = 1$ (i.e. when $\mu^i = -1 + 1 = 0$). The right-hand side of (26) becomes zero and we can conclude

$$\frac{y_m}{\bar{y}} > 0 \Longrightarrow t^{*i} = 0 < t^{f*}$$

Then let $w = 0$. The inequality in (20) is

$$\frac{y_m}{\bar{y}} \; ? \lesseqgtr ? \; a$$

So obviously the right-hand side of (20)) varies along $[0, a]$. We already know that $\frac{y_m}{\bar{y}} \in (0,1)$ and $a \in (0,1)$. Therefore, we can state two more conditions

(*) if $a < \frac{y_m}{\bar{y}} < 1$, then $\mu^i > \mu^f \Longrightarrow t^{i*} > t^{f*}$

(**) if $\frac{y_m}{\bar{y}} < a < 1$, then we cannot immediately conclude anything because it all depends on where the exogenous variable $\bar{w}$ is between $(0, a)$.

Note that a is the weight parameter on leisure in the utility function of the worker. So whether the formal sector tax rate is higher than informal rate relates to (or is affected by) how much he likes leisure and the relative standing of his earned income with respect to the average income in the formal sector.

The analysis will be concluded if it can be shown that (**) cannot be the case. In particular, we need to check for the ambiguous inequality below

$$\frac{\bar{y}}{y_m} = \frac{G(K)\int_{\varepsilon^*}^{\infty}\left[(1-a)-\frac{at\bar{y}}{(1-t)G(K)\varepsilon}\right]\varepsilon f(\varepsilon)d\varepsilon}{\varepsilon^m(1-a)G(K)-\frac{at\bar{y}}{(1-t)}} \gtrless a$$

which after simplification becomes,

$$G(K)(1-a)\left[\int_{\varepsilon^*}^{\infty}\varepsilon f(\varepsilon)d\varepsilon - a\varepsilon^m\right] \gtrless \frac{at\bar{y}}{(1-t)}\left[\int_{\varepsilon^*}^{\infty} f(\varepsilon)d\varepsilon - a\right]$$

However it is not possible to conclude which side of the inequality is bigger since endogenously determined variables affect the outcome.

(ii) If $\bar{w} > 1$, $t^{i*} > t^{f*}$. See [(II)-a)] below. However, when $\bar{w}$ is sufficiently high, the median worker will switch to the informal sector.

(II) If $\bar{w}$ becomes high enough so that the median voter decides to work in the informal sector, then we observe equation (24) being solved.

a) When $\bar{w} > 1$, regardless of what the $\frac{y^m}{\bar{y}}$ ratio is, the deadweight loss incurred by the informal sector decisive voter is higher than the loss were this voter in the formal sector. Specifically, from (24)

$$\bar{w} > 1 \rightarrow \mu^i < -1$$

Since $-1 < \mu^f < 0$ always hold, tax incurred by the informal median worker causes a higher deadweight loss, hence $t^{i*} > t^{f*}$. This clearly refers to the flat line in Figure 1.

b) When $0 \leq \bar{w} \leq 1$, see the inconclusive condition [(I)-(i)] above. Note that the worker will not stay in the informal sector if $\bar{w}$ is low enough.

Appendix C. Endogenizing the Choice of Tax Rates.

Given the balanced budget condition $s = t\bar{y}$ and $n^{i*} = (1-a) - \frac{as}{\bar{w}}$,the individual chooses t to maximize

$$u^i = (1-a)\ln\left((1-a)(\bar{w}+t\bar{y})\right) + a\ln\left(a + \frac{at\bar{y}}{\bar{w}}\right)$$

subject to

$$\bar{y} = \frac{(1-a)G(K)\int_{\frac{\bar{w}}{1-t}}^{\infty}\varepsilon f(\varepsilon)d\varepsilon}{1+\frac{at}{1-t}\left(1-F\left(\frac{\bar{w}}{1-t}\right)\right)}$$

where $F\left(\frac{\bar{w}}{1-t}\right)$ is the cumulative lognormal distribution of productivity evaluated at$\frac{\bar{w}}{1-t}$. and $f(\varepsilon) = \frac{1}{\sqrt{2\pi}\sigma(\varepsilon)}e^{-1/2((\ln(\varepsilon)-\mu)/\sigma)^2}$.Assuming $\bar{w}+t\bar{y} \neq 0$, taking the derivative of u^i with

respect to t leads to the following first order condition:

$$\bar{y} + t\frac{d\bar{y}}{dt} = 0$$

which has to be solved for t.

Let $\frac{d\bar{y}}{dt} = \frac{1}{B}\frac{\partial A}{\partial t} - \frac{A}{B^2}\frac{\partial B}{\partial t}$, where $A = (1-a)\,G(K)\int_{\frac{\bar{w}}{1-t}}^{\infty} \varepsilon f(\varepsilon)\,d\varepsilon$ and $B = 1 + \frac{at}{1-t}\left(1 - F\left(\frac{\bar{w}}{1-t}\right)\right)$.

Using Leibniz rule yields:

$\frac{\partial A}{\partial t} = -(1-a)G(K)(\frac{\bar{w}^2}{(1-t)^3})f(\frac{\bar{w}}{1-t})$
and
$\frac{\partial B}{\partial t} = \frac{1}{(1-t)^2}\left[1 - F(\frac{\bar{w}}{1-t})\right] - \frac{at\bar{w}}{(1-t)^3}f(\frac{\bar{w}}{1-t})$

$$\frac{d\bar{y}}{dt} = \frac{-(1-a)G(K)(\frac{\bar{w}^2}{(1-t)^3})f(\frac{\bar{w}}{1-t})}{\left[1+\frac{at}{1-t}\left(1-F\left(\frac{\bar{w}}{1-t}\right)\right)\right]} -$$

$$-\frac{(1-a)G(K)\left[\frac{1}{(1-t)^2}\left[1-F(\frac{\bar{w}}{1-t})\right]-\frac{at\bar{w}}{(1-t)^3}f(\frac{\bar{w}}{1-t})\right]\int_{\frac{\bar{w}}{1-t}}^{\infty}\varepsilon f(\varepsilon)d\varepsilon}{\left[1+\frac{at}{1-t}\left(1-F\left(\frac{\bar{w}}{1-t}\right)\right)\right]^2}$$

when substituted in the first order condition leads to

$$\frac{(1-a)G(K)\int_{\frac{\bar{w}}{1-t}}^{\infty}\varepsilon f(\varepsilon)d\varepsilon}{1+\frac{at}{1-t}\left(1-F\left(\frac{\bar{w}}{1-t}\right)\right)} +$$

$$+t\frac{-(1-a)G(K)(\frac{\bar{w}^2}{(1-t)^3})f(\frac{\bar{w}}{1-t})\left[1+\frac{at}{1-t}\left(1-F\left(\frac{\bar{w}}{1-t}\right)\right)\right]}{\left[1+\frac{at}{1-t}\left(1-F\left(\frac{\bar{w}}{1-t}\right)\right)\right]^2} -$$

$$-t\frac{(1-a)G(K)\left[\frac{1}{(1-t)^2}\left[1-F(\frac{\bar{w}}{1-t})\right]-\frac{at\bar{w}}{(1-t)^3}f(\frac{\bar{w}}{1-t})\right]\int_{\frac{\bar{w}}{1-t}}^{\infty}\varepsilon f(\varepsilon)d\varepsilon}{\left[1+\frac{at}{1-t}\left(1-F\left(\frac{\bar{w}}{1-t}\right)\right)\right]^2} = 0$$

or

$$\left[1 + \frac{at}{1-t}\left(1 - F\left(\frac{\bar{w}}{1-t}\right)\right)\right]\int_{\frac{\bar{w}}{1-t}}^{\infty}\varepsilon f(\varepsilon)\,d\varepsilon -$$

$$-t(\frac{\bar{w}^2}{(1-t)^3})f(\frac{\bar{w}}{1-t})\left[1 + \frac{at}{1-t}\left(1 - F\left(\frac{\bar{w}}{1-t}\right)\right)\right] -$$

$$-t\left[\frac{1}{(1-t)^2}\left[1 - F(\frac{\bar{w}}{1-t})\right] - \frac{at\bar{w}}{(1-t)^3}f(\frac{\bar{w}}{1-t})\right]\int_{\frac{\bar{w}}{1-t}}^{\infty}\varepsilon f(\varepsilon)\,d\varepsilon = 0$$

$$\int_{\frac{\bar{w}}{1-t}}^{\infty}\varepsilon f(\varepsilon)\,d\varepsilon\left[1 + \left(1 - F\left(\frac{\bar{w}}{1-t}\right)\right)\left(\frac{at}{1-t} - \frac{t}{(1-t)^2}\right) - \frac{at^2\bar{w}}{(1-t)^3}f(\frac{\bar{w}}{1-t})\right]$$

$$-\left(\frac{t\bar{w}}{(1-t)^3}\right)f\left(\frac{\bar{w}}{1-t}\right)\left[\bar{w}+\frac{a\bar{w}t}{1-t}\left[1-F\left(\frac{\bar{w}}{1-t}\right)\right]+at\int_{\frac{\bar{w}}{1-t}}^{\infty}\varepsilon f\left(\varepsilon\right)d\varepsilon\right]-$$

$$-\left[\frac{t^2(1-a)+t(1-a)+1}{(1-t)^2}\left(1-F\left(\frac{\bar{w}}{1-t}\right)\right)\right]\int_{\frac{\bar{w}}{1-t}}^{\infty}\varepsilon f\left(\varepsilon\right)d\varepsilon=0$$

where $f\left(\frac{\bar{w}}{1-t}\right)=\frac{1}{\sqrt{2\pi}\sigma\left(\frac{\bar{w}}{1-t}\right)}e^{-1/2\left(\left(\ln\left(\frac{\bar{w}}{1-t}\right)-\mu\right)/\sigma\right)^2}$,

$F\left(\frac{\bar{w}}{1-t}\right)=\frac{1}{2}+\frac{1}{2}\,\mathrm{erf}\left[\frac{\ln\left(\frac{\bar{w}}{1-t}\right)}{\sigma\sqrt{2}}\right]$,

and $\mathrm{erf}\left[\frac{\ln\left(\frac{\bar{w}}{1-t}\right)}{\sigma\sqrt{2}}\right]=\frac{2}{\sqrt{\pi}}\int_0^{\frac{\ln\left(\frac{\bar{w}}{1-t}\right)}{\sigma\sqrt{2}}}e^{-x^2}dx$

8 References:

Alesina, A., Rodrik, D.,1994. Distributive politics and economic growth. Quarterly Journal of Economics 109, 465-490.

Benabou, R., 1996. Inequality and growth. NBER Macroeconomics Annual: 11-74

Chong, A., Gradstein, M., 2007. Inequality and informality. Journal of Public Economics 91, 159-179.

DeSoto, H. 1989. The Other Path: The Informal Revolution. New York:Harper and Row.

Dessy, S., Pallage, S., 2003. Taxes, inequality and the size of the informal sector. Journal of Development Economics 70, 225-233.

Encuesta Nacional de Ingresos y Gastos de los Hogares, (ENIGH), Instituto Nacional de Estadística, Geografía e Informática. Aguascalientes, México.

Fortin, B., Marceau, N., and L. Savard, 1997. Taxation , wage controls, and the informal sector. Journal of Public Economics 66, 293-312.

Friedman, E., Johnson,S., Kaufmann, D., and P. Zoido-Lobatón, 2000. Dodging the grabbing hand: the determinants of unofficial activity in 69 countries. Journal of Public Economics 76, 459- 493.

Gaertner, W., Wenig, A., 1985. The Economics of the Shadow Economy. Berlin: Springer-Verlag.

Heston, A., Summers, R., and B. Aten, 2006. Penn World Table Version 6.2, Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania.

Ihrig, J., Moe, K., 2004. Lurking in the shadows: the informal sector and government policy. Journal of Development Economics,73, 541-557.

IMF. 1991. Government Finance Statistics Yearbook.

Imrohoroglu, A., Merlo, A., and P. Rupert, 2000. On the political economy of income redistribution and crime. International Economic Review 41, 1-25.

Juster, F.T, Stafford, F. P., 1991. The allocation of time: empirical findings, behavioral models, and problems of measurement. Journal of Economic Literature 29, 471-522.

Krusell, P. and Rios-Rull., J-V. 1999. On the size of US government: political economy in the neoclassical growth model. The American Economic Review 89, 1156-1172.

Kydland, F.E., Prescott, E. C., 1982. Time to build and aggregate fluctuations. Econometrica 50, 1345-1370.

Lemieux, T., Fortin, B. and P. Frechette, 1994. The effect of taxes on labor supply in the underground economy. The American Economic Review 84, 231-254.

Loayza, N.V., 1994. Labor relations and the informal economy. The World Bank Policy Research Working Paper 1335.

———————— . 1996. The Economics of the Informal Sector: A Simple Model and Empirical Evidence from Latin America. Carnegie-Rochester Conference Series on Public Policy 45, 129-162.

Mazumdar, D. 1976. The urban informal sector. World Development 4, 655-679.

Meltzer, A. H., and Richard, S. F., 1981.A rational theory of the size of government. The Journal of Political Economy 5, 914-927.

DePaula, A., and Scheinkman, J., 2006. The informal sector. University of Pennsylvania Working Paper.

Portes, A., Schauffler R., 1993. Competing perspectives on the Latin American informal sector. Population and Development Review 19, 33-60.

Rauch, J.E., 1991. Modelling the informal sector formally. Journal of Development Economics 35, 33-47.

Roberts, K. W. S., 1977. Voting over income sax Schedules. Journal of Public Economy 8, 329-40.

Schneider, F., 2002, Size and measurement of the informal economy in 110 countries around the world. Working Paper. Department of Economics, Johannes Kepler University of Linz

_____, 2006. Shadow economies of 145 countries all over the world: what do we really know? Johannes Kepler University of Linz, Manuscript.

Schneider, F., Enste, D.H., 2000. Shadow economies: size, causes, and consequences. Journal of Economic Literature 38, 77-114.

Sethuraman, S. V., 1991. Report to the Director-General to the International Labor Conference in 1991. ILO: Geneva.

_____,.1998. Urban Poverty and the Informal Sector: A Critical Assessment of Current Strategies. ILO: Geneva.

Thomas, J. J., 1992. Informal Economic Activity. The University of Michigan Press: Ann Arbor.

Tokman, V. E., 1990. The informal sector in Latin America: fifteen years later in the informal sector revisited. In: David Turnham, Bernard Salome, and Antoine Schwarz (Eds.), OECD Development Center Seminars: Paris.

U.S. Department of Commerce, Bureau of the Census. 1995. Statistical Abstract of the United States.

World Bank. 1992. The World Development Indicators.

Table 1. Coefficient of the Informal Sector Size[1]

Dependent Variable : Social Security and Welfare Spending as a Percentage of GDP

Model[2]	*Pooled OLS*	*Fixed Effects*	*Random Effects*
1	-0.23(3.62)	-0.12(1.88)	-0.52(3.79)
2	-0.33(4.35)	-0.34(2.65)	-0.92(5.44)
3	-0.21(1.98)	-0.22(3.42)	-0.12(3.10)

[1] t-statistics in parenthesis

[2] Model 1: Informal Sector Size

Model 2: Informal Sector Size, Tax Revenues/GDP

Model 2: Informal Sector Size, Tax Revenues/GDP, Gini Coefficient

Table 2. Effects of Change in the Informal Sector Wage on Taxes: Simulation Results.

	Tax Rates		*Critical Productivity*		*Income*	
	USA	*Mexico*	*USA*	*Mexico*	*USA*	*Mexico*
Informal Sector Wage: w						
0.1	0.27	0.73	0.02	0.63	$21,204	$8959
0.2	0.28*	0.72*	0.06*	0.66*	$20,960*	$9,571*
0.3	0.26	0.71	0.16	0.81	$21,333	$10,340
0.4	0.21	0.68	0.26	0.85	$21,642	$10,629
0.5	0.21	0.65	0.64	0.87	$23,045	$10,863

Table 3. Effect of the Change in the Identity of the Decisive Voter in Mexico

Identity of the Median Voter : ε^m	0.5	0.55	0.6	0.65	0.7	0.75
Equilibrium Tax Rate : t	0.72	0.72	0.66	0.64	0.43	0.05
Critical productivity : $\varepsilon^?$	0.66	0.66	0.61	0.60	0.47	0.32

Table 4. Political-Economic Equilibria.

	Democratic USA	*Democratic Mexico*	*Undemocratic Mexico*
Equilibrium Tax Rate : t	0.28	0.72	0.05
Critical productivity : $\varepsilon^{?}$	0.065	0.66	0.32
Per Capita Income	$20,960	$9571	$15059

Table 5. Effect of Change of the Leisure Paremeter (USA)

Leisure Parameter: a	0.5	0.55	0.6	0.65	0.7	0.8
Equilibrium Tax Rate : *t*	0.31	0.3	0.28	0.27	0.26	0.25
Critical productivity : $\varepsilon^{?}$	0.073	0.07	0.065	0.062	0.06	0.05

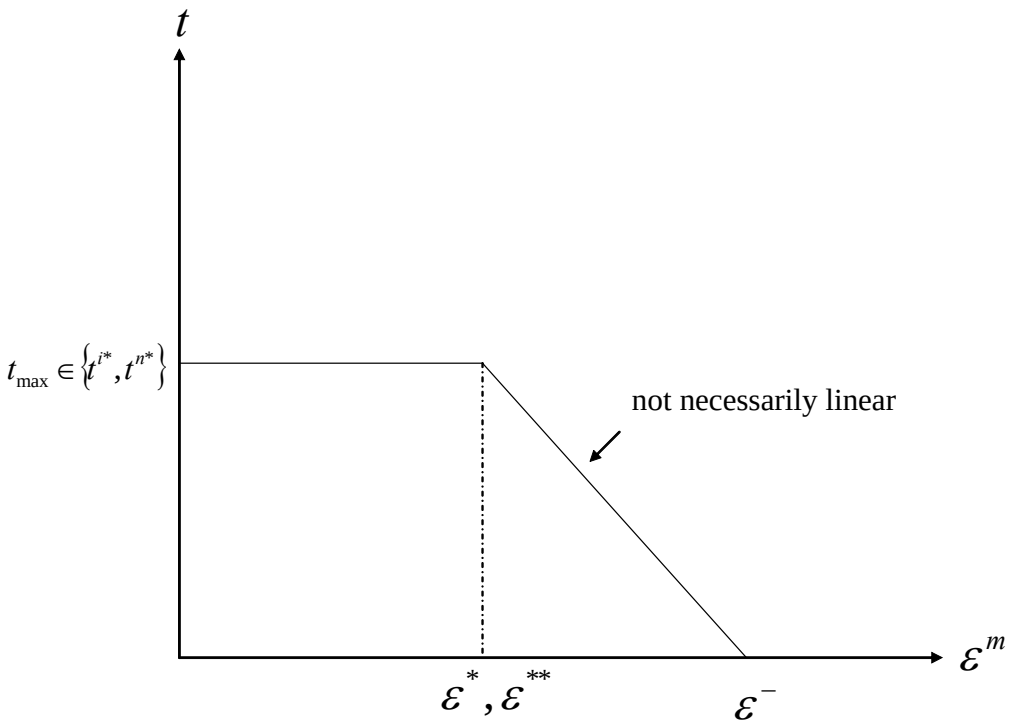

Figure 1. Identity of the Median Voter